Version 8 SBUV ozone profile trends compared with trends from a zonally averaged chemical model

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[1] A statistical time series analysis was applied to the new version 8 merged Solar Backscatter Ultraviolet (SBUV) data set of ozone profiles for the years 1979–2003. Linear trends for the 1979–1997 time period are reported and are compared to trends computed using ozone profiles from the Goddard Space Flight Center (GSFC) zonally averaged coupled model. Observed and modeled annual trends between 50°N and 50°S were a maximum in the higher latitudes of the upper stratosphere, with Southern Hemisphere (SH) trends greater than Northern Hemisphere (NH) trends. The observed upper stratospheric maximum annual trend is $-7.0 \pm 2.0\%$/decade (2σ) at 47.5°S and $-4.7 \pm 1.3\%$/decade at 47.5°N, to be compared with the modeled trends of $-5.8 \pm 0.3\%$/decade in the SH and $-5.2 \pm 0.3\%$/decade in the NH. Both observed and modeled trends are most negative in winter and least negative in summer, although the modeled seasonal difference is less than observed. Model trends are shown to be greatest in winter because of a repartitioning of chlorine species and the increasing abundance of chlorine with time. The model results illustrate the trend differences that can occur at 3 hPa depending on whether ozone profiles are in mixing ratio or number density coordinates and on whether they are recorded on pressure or altitude levels.

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1. Introduction

[2] Stratospheric ozone profile measurements have been made by the Solar Backscatter Ultraviolet instruments (SBUV and SBUV/2) since November 1978. *Hood et al.* [1993] estimated ozone trends using Nimbus 7 SBUV data for the period November 1978 to June 1990. They found maximum upper stratospheric annual trends, poleward of 50°, of approximately −8%/decade in the Northern Hemisphere (NH) and approximately −12%/decade in the Southern Hemisphere (SH). Depletions increased with increasing latitude in both hemispheres. They reported maximum upper stratospheric high-latitude negative trends in the late fall and early winter seasons.

[3] *Hollandsworth et al.* [1995] combined reprocessed Nimbus 7 SBUV ozone data with observations from the SBUV/2 instrument on NOAA 11, and computed updated profile trends for the period November 1978 through June 1994. They found a general pattern of ozone loss similar to that computed by *Hood et al.* [1993], but obtained smaller negative trends with the additional data. Maximum high-latitude upper stratospheric trends were approximately −8%/decade in the NH and approximately −10%/decade in the SH. They also reported maximum high-latitude upper stratospheric negative trends in the late fall and early winter.

[4] A large group of research scientists [*World Meteorological Organization* (*WMO*), 1998; *Randel et al.*, 1999; *Newchurch et al.*, 2000; *Cunnold et al.*, 2000] reevaluated the vertical distribution of ozone trends for the period 1979 to 1996, including trends from the SBUV and the Stratospheric Gas and Aerosol Experiment (SAGE) instruments. They confirmed the previously reported latitudinal structure of trends, i.e., a maximum negative trend in the extra tropics and a minimum negative trend in the tropics, with a minimum downward trend at all latitudes at ~30 hPa. They concluded that SAGE trends were more negative than SBUV trends at nearly all latitudes. In the midlatitudes maximum upper stratospheric trends were approximately −9%/decade for SAGE and approximately −5%/decade for SBUV. SAGE annual trends were shown to have no statistically significant interhemispheric difference. They found that although SBUV upper stratospheric annual trends were more negative in the SH than the NH, this difference

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